



AZUR SPACE SOLAR POWER GMBH

# Power electronic and optoelectronic semiconductor devices

**AZUR SPACE Solar Power GmbH (AZUR SPACE) develops, produces and distributes semiconductor-based components for power and optoelectronics. AZUR SPACE, based in Heilbronn, Germany, is a globally active medium-sized company with around 250 employees. It develops and produces highly efficient solar cells and concentrator cells for space and terrestrial applications. The photo-voltaic systems are used to generate electrical power from sunlight both in space and for terrestrial applications. The special know-how lies in the area of multi-junction solar cells (triple, quadruple and quintuple solar cells), which are characterised by a particularly high degree of efficiency. For some years now, AZUR SPACE has been using this know-how in the field of compound semiconductors for other, specialised fields of application and has begun researching and developing power electronic and optoelectronic semiconductor components.**

## Challenges

Modern automotive and industrial applications require energy-efficient microchips, power electronics for high currents or voltages as well as integrated sensors and advanced optical devices. To meet the ever-increasing demands for efficiency, compactness, robustness, performance and special physical or chemical properties, so-called III/V compound semiconductors must be used. These are material compounds such as gallium arsenide, gallium phosphide or gallium nitride. In power electronics, transistors based on gallium nitride (GaN HEMTs) – in contrast to classic silicon-based transistors – can achieve very high switching frequencies and thus very high energy efficiency. These are relevant for manufacturers of chargers and amplifiers for electric or hybrid cars, electric motor companies and for companies working in the wind turbine sector, smart energy grids or e-mobility for trains and ships.

## Objective

As the use of gallium nitride-based devices is still in its infancy, AZUR SPACE could use its know-how to close the gap in the European supply chain and develop and manufacture the semiconductor substrates (GaN epitaxial wafers) for the aforementioned fields of application. To this end, AZUR SPACE is planning to set up new production lines for the production of gallium arsenide (GaAs) optoelectronics, as well as GaAs and gallium nitride (GaN) power electronics. This will make it possible to develop and market new, customised microelectronic products for various fields of application. Specifically, optical energy converters such as high-voltage photodiodes or laser power converters as well as free-wheeling diodes or High Electron Mobility Transistors (HEMTs) are being developed. These components are more robust and more efficient than existing solutions and offer the possibility of realising high switching frequencies with reduced power dissipation. The production should be designed

### Project coordinator

Dr. Gerhard Strobl  
AZUR SPACE Solar Power GmbH  
Theresienstr. 2  
74072 Heilbronn  
Phone: +49 (0)7131 / 67 - 3190  
gerhard.strobl@azurspace.com  
www.azurspace.com

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### Location

Heilbronn



to be cost-effective with high product quality in order to be able to compete with the established silicon technologies.

### Approaches

AZUR SPACE's work involves, in a first step, setting up a production line for GaN HEMT devices on silicon wafers. In a second step, the GaN transistors will finally be manufactured directly on GaN substrates. In this way, the electrical behaviour of the components can be improved and their service life increased. In parallel to this, AZUR SPACE is building the production line for new III/V compound semiconductors, which are used, for example, in lithography, etching or coating. As AZUR SPACE is developing a complete ecosystem for composites, it covers the entire manufacturing chain and a wide range of technology fields. Even partners with very specialised products can benefit, as customised solutions are possible. The work goals announced in the project clearly exceed the current state of the art. In its further development, the company can draw on its many years of experience in the field of III/V solar cells and close cooperation with various research institutions. Synergies exist in this area with companies such as Osram, Bosch, Infineon and TDK-Micronas.

### Perspectives

In order to disseminate the results and transfer knowledge, cooperation with universities and research institutions as well as participation in symposia and conferences is planned. This will promote the practical training of young scientists. AZUR SPACE will also cooperate with European subcontractors who were not previously among its business partners. The components to be developed in the field of electrical energy conversion and optical signal transmission without

external energy supply offer the possibility of establishing part of the value creation at competitive costs in Europe. This applies in particular to growing fields of application such as energy, e-mobility, radar, space travel, power supply for wind turbines or autonomous systems.

A sales market for optoelectronic and electronic components is offered by battery and automotive applications, power electronics, power-by-light applications and wind turbines. In the optoelectronics sector, AZUR SPACE has the opportunity to establish itself as a supplier of customised chips and to position itself on the market as a supplier of specific semiconductor substrates for Germany with its GaAs free-wheeling diodes and GaN-HEMT power transistors.

AZUR SPACE can thus occupy new business fields, create new jobs in Germany and secure existing ones. With the development of high-performance, energy-saving and cost-effective semiconductor solutions, this project contributes to advancing the key technology of micro- and nanoelectronics as a common European goal.

### Contact

Federal Ministry for Economic Affairs and Climate Action (BMWK)  
Dr. Uwe Sukowski  
Phone: +49 (0)30 18625-7695  
BUERO-IVA2@bmwi.bund.de

VDI/VDE Innovation + Technik GmbH  
(Project Management Agency for the IPCEI on Microelectronics of the German Federal Ministry)  
Christoph Reich  
Phone: +49 (0)30 310078-5763  
Christoph.Reich@vdivde-it.de

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